



Alternating gender incongruity: A new neuropsychiatric syndrome providing insight into the dynamic plasticity of brain-sex

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ABSTRACT

Between the two extreme ends of human sexuality – male and female – lie a poorly understood and poorly studied spectrum of ambiguously defined sexual identities that are very much a part of the human condition but defy rigid classification. “Bigender” is a recently formed sub-category of transgenderism, describing individuals who experience a blending or alternation of gender states. While recognized nominally by the APA, no scientific work to our knowledge has addressed this fascinating condition, or proposed any physiological basis for it. In addition, the alternation aspect has not been proposed as a nosological entity distinct from blending. We present descriptive data suggesting that many bigender individuals experience an involuntary switching of gender states without any amnesia for either state. In addition, similar to transsexual individuals, the majority of bigender individuals experience phantom breasts or genitalia corresponding to the non-biologic gender when they are in a trans-gender state. Finally, our survey found decreased lateralization of handedness in the bigender community. These observations suggest a biologic basis of bigenderism and lead us to propose a novel gender condition, “alternating gender incongruity” (AGI). We hypothesize that AGI may be related to an unusual degree or depth of hemispheric switching and corresponding callosal suppression of sex appropriate body maps in parietal cortex – possibly the superior parietal lobule – and its reciprocal connections with the insula and hypothalamus. This is based on two lines of reasoning. First, bigender individuals in our survey sample reported an elevated rate of bipolar disorder, which has been linked to slowed hemispheric switching. We hypothesize that tracking the nasal cycle, rate of binocular rivalry, and other markers of hemispheric switching will reveal a physiological basis for AGI individuals’ subjective reports of gender switches. Switching may also trigger hormonal cascades, which we are currently exploring. Second, we base our hypotheses on ancient and modern associations between the left and right hemispheres and the male and female genders. By providing a case of sharp brain-sex shifts within individuals, we believe that the study of AGI could prove illuminating to scientific understanding of gender, body representation, and the nature of self.

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Introduction

Under the transgender umbrella, a distinct subset of “Bigender” individuals report blending or alternating gender states. It came to our attention that many (perhaps most) bigender individuals experience *involuntary* alternation between male and female states, or between male, female, and additional androgynous or other-gendered identities (“Multigender”). This fascinating phenomenon is given only passing recognition in one brochure produced by the American Psychological Association [1]. Furthermore, no attention has been paid to its possible physiological basis, or to its enormous ramifications for the understanding of sex and gender. Sex and gender are most commonly considered a single entity, but dissociations

between external morphology, gender identity, body image sex, and sexual orientation demonstrate that at least four components interact together create a consistent- or less consistent- sex and gender identity for any given individual. Bigender individuals who alternate gender present a unique case where single components of sex and gender may vary within an individual. For the purposes of our research we are calling this condition “alternating gender incongruity” (AGI). We seek to establish AGI as a nosological entity based in an understanding of dynamic brain representations of gender and sex. The day-to-day oscillation of something as axiomatically “binary” as sex is potentially of extraordinary importance.

A survey of the transgender community by the San Francisco Department of Public Health found that about 3% of genetic males and 8% of genetically female transgendered individuals identified as bigender [2]. To our knowledge, however, no scientific literature

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has attempted to explain or even describe bigenderism; a search of PsychInfo and PubMed databases returned zero results for “bigner” or “bigenderism.” This may be due to the low prevalence of bigenderism and relatively recent adoption of the term by bigender individuals. Several extraordinary observations about bigenderism, however, suggest to us that the study of this condition could prove illuminating to scientific understanding of gender, body representation, and the nature of self.

Alternation of gender states might easily be explained away by the socially constructed nature of gender and the fact that transsexual and androgynous individuals might be more comfortable exploring both masculine and feminine-associated components of their personalities. However, reports that the switches in gender typically feel involuntary piqued our interest in a possible neurological explanation for this condition. We found that many bigender individuals even report switching at inopportune moments when they would much prefer to remain in their current gender consistent with their dress and presentation. Furthermore, bigender individuals often feel that their voice, emotional response, style of thinking, social interactions, and even sense of anatomy change spontaneously and that their identification of feeling “male” or “female” tracks these involuntary changes. Several phenomenological questions inevitably arise. How frequent are the gender transitions? How rapidly do they occur? More importantly: do the four aspects of sexuality – gender identity (which sex you categorize yourself or see as others see you), sexual morphology, brain-based “sexual body image,” and sexual orientation (who you are attracted to) switch simultaneously or – at least partially – independently?

Survey of alternating gender incongruity

To collect some initial observations on AGI we conducted a survey posted on an online forum created by and for people who identify as bigender. This forum hosts around 600 members, some of whom contribute to the forum and others who only read material others have posted. Our complete survey is attached in [Appendix A](#). We restricted our data analysis to individuals who reported experiencing alternating (or cycling) gender, excluding bigender individuals who felt a more static blend of both male and female genders. 39 individuals completed our full survey. Of these, three were excluded who did not report experiencing alternating gender, one was excluded because of a diagnosis of Multiple Personality Disorder (a disorder that would better explain the multiplicity of genders experienced by the individual), and three final respondents were excluded for possible dissociative identity disorder (DID; both reported experiencing some amnesia for experiences in one gender). Thus in our sample of bigender individuals the vast majority experienced gender alternation in the absence of signs of DID. Other psychiatric disorders were present in this subgroup, but no disorder was common enough to plausibly underlie gender alternation: 15/30 reported depression, 6 reported PTSD, 7 reported an anxiety disorder, 8 reported bipolar disorder, and 2 reported an Autism Spectrum Disorder. While these rates of psychological disorders are clearly elevated from the non-bigender population, we cannot draw any causal conclusions from this fact, as gender dysphoria itself tends to cause anxiety and depression, and may precipitate other mental disorders a given individual is at risk for.

Participant characteristics and frequency of gender switching

Of the 32 alternating bigender respondents included in our analysis, 11 were anatomically female (identified as female at birth). Three respondents reported undergoing chromosomal sex testing and the two males who reported the results of this testing

had a “normal XY karyotype.” One respondent identified as intersex but only for reasons of androgynous facial appearance. The average age of respondents was 28.6 (SD = 10.4; range 17–50 years). Five respondents (all male at birth) reported currently taking hormones to mediate their gender identity (estrogen, estradiol, Spironolactone, and Finasteride, a synthetic antiandrogen).

10/32 respondents agreed that their gender switches were “predictable.” The period of gender switches was highly variable, ranging from multiple times per day to several times per year. A majority (23/32) of respondents, however, reported that their gender switched at least weekly:

Multiple times a day or daily: 14;
Several times a week or weekly: 9;
Several times a month or monthly: 6;
Several times a year: 3.

We did not systematically survey participants about sexual orientation, but based on reports provided by several participants we believe that sexual orientation sometimes switches along with gender and sometimes does not.

Participants provided a variety of insights into their switches between gender states

“I still have the same values and beliefs, but a change in gender is really a change in the filter through which I interact with the world and through which it interacts with me.”

“My voice usually ends up being higher than other times, I’ll be more emotional, my views on things like politics tend not to change, but how I react to certain things does. Like if I’m in male mode and I see someone crying I’ll think more along the lines of, “Man up...” while if I’m in girl mode I’ll think more along the lines of ‘Oh sweetie!’ ”

“I just feel completely different, the only way I can explain it is ‘one minute I’m a boy, next thing I’m a girl’, everything is different.”

Phantom body parts

We previously proposed a gender-specific body image hard-wired in the brain as a partial account of transsexuality and explanation for the phantom breasts and genitalia experienced by transsexual individuals [3]. The hypothesis was that female-to-male transsexuals – for example – had female external anatomy but their internal body image (constructed in the right parietal and insula) was hard-wired to be male. Many of them experience phantom penises with phantom erections, consistent with our theory.

If bigender individuals had two body gender maps in their brains, we would expect to see phantom body parts (e.g. breasts and genitalia) corresponding to the “opposite” gender during the gender state incongruent with their anatomy, and for these phantom body parts to be masked during cissexual gender phases. We also expected a high prevalence of phantom body parts because of interviews with one local bigender individual and her reports that this is a common experience for other AGI individuals.

Indeed, many bigender individuals with alternating gender report phantom body parts cycling with their gender. 21/32 bigender respondents reported experiencing phantom body parts and rated them as moderate in strength (mean = 2.9 on a scale of 1 = weak and 5 = very strong).

Respondents spoke strongly about their phantom body parts

From anatomically female respondents

Respondent A: “I sometimes wake up thinking I have a penis, or that I have no breasts . . . I usually end up in tears and I can’t get out of bed because once I get up I’ll know for sure it’s not really true and it’s just my mind playing tricks on me, so I just lie there and cry. It’s strange though because I normally don’t even want to have a penis.”

Respondent B: “I feel very strongly as though my body is trying to make a penis work and doesn’t understand why there isn’t one there.”

From anatomically male respondents

Respondent C: “The sensation is very vague and only hints at the presence of those parts, although the size of the phantom breasts does feel surprisingly specific.”

Respondent D: “I just know my genitals are there, correct for whatever mode I am in and exactly as they would be if I were cisgender.”

Respondent E: “I feel like the parts are supposed to be there but that feeling is easily broken upon visual confirmation.”

One biologic male reported that his gender ceased to cycle after hormonal treatment (Spironolactone 200 mg/day and Estradiol Valerate 10 mg/week). This participant reported “*back when I identified as bigender and not on hormones, I strongly felt phantom breasts. But growing just a little breasts (sic) made it vanish. I still experience a strong phantom vagina.*”

Are phantom body parts merely a result of wishful thinking? We argue that the involuntary nature of the phantom body parts argues in favor of a neurologic explanation for their existence. Indeed, the involuntarily nature of gender switches extends to the phantom body parts, such that an unwelcome switch from female to male (in an anatomical female) might be accompanied by an undesired phantom penis inconsistent with the individual’s dress and social presentation. Respondents reported that phantom body parts usually switched appropriately with gender, but five respondents reported that phantom body parts occasionally got “stuck” with the wrong gender. The fact that phantom parts occasionally persist in the incongruent gender argues against confabulation, as a body part willed into existence would be unlikely not to cooperate.

Handedness

Handedness shows associations with both gender and psychopathology. A higher incidence of left-handedness is seen in homosexuality [4], and handedness is also tied to performance on cognitive tasks such as mental rotation that traditionally show sex differences [5]. Individuals with schizophrenia exhibit higher rates of left and mixed handedness, while individuals with bipolar disorder 1 exhibit greater lateralization of handedness than non-psychiatric populations. These differences in handedness are believed to reflect anomalous cerebral lateralization [6]. Since bigender individuals exhibit shifts in gender expression as well as elevated rates of bipolar disorder, we examined handedness in AGI to see whether this population exhibits this marker of unusual lateralization. We had also heard anecdotal reports that members of the bigender community had found themselves to have a high rate of ambidexterity.

Indeed, in our survey 6 of 28 individuals (more than a fifth) self-identified as ambidextrous. An additional respondent indicated having been ambidextrous as a child before being forced to choose a single hand to use. Only three indicated that they were left-handed. In contrast, only 2 of 62 cissexual control participants

indicated being ambidextrous, and 9 of 62 left-handed. We computed the absolute value of the Edinburgh Handedness Survey score for each participant and found handedness values closer to zero (zero being ambidextrous) in bigender respondents than in normal controls ($t(107) = 2.32$, $p = 0.022$).

While sex differences research rejects the existence of large differences in hemispheric specialization between the sexes (e.g. [7]), males and females do differentially engage these hemispheres in certain tasks (e.g. [8]) and sex differences on language and spatial tasks are tied to functions of these hemispheres. In fact, research on the nasal cycle has found contralateral hemispheric activation associated with nasal swelling and autonomic activation [9], and spatial and language abilities are correlated with phase of the nasal cycle [10,11]. Could alternating hemispheric dominance, perhaps tied to the nasal cycle, be accompanied by pronounced changes in gender in some individuals? Such anomaly in hemispheric dominance switching might also manifest as increased ambidexterity.

As previously mentioned, bigender respondents also reported diagnosis of bipolar at an elevated rate (9 of 32). This is interesting because individuals with bipolar have been found to have slowed interhemispheric switching rates, as evidenced by slower binocular rivalry alternation rates, themselves a correlate of nasal cycle [12]. If hemispheric dominance relates to both changes in emotion and cognitive performance on tasks that show sex differences, extreme switches in functional hemispheric dominance might create shifts in gender inclusive of emotions, cognition, and even body image. It is possible that a body image could contain both male and female body parts and body boundaries, and be turned off and on by dynamic network shifts in the brain controlled by hemispheric dominance.

Discussion

What could cause such a powerful change in sense of gender on such a frequent time scale? We propose – and are currently investigating – several related theories of alternating gender incongruity: (1) unusual, amplified patterns of functional hemispheric dominance might result in alternating suppression of brain networks orchestrating more “male” or “female” cognition and emotion; (2) unusual patterns of hemispheric dominance might relate to alternating patterns of sympathetic/parasympathetic nervous system control, including different patterns of emotional reactivity; (3) individuals with unusual development of sensory and parietal body maps might have redundant, differently-gendered body maps competing for sensory input. Shifts in use of these body maps might lead to a different feeling of one’s normative anatomy and its relationship to one’s anatomic body. Finally, coordination between shifts in brain connectivity, autonomic response, hormone release, and dynamic representation of body gender might together create the sense of gender alternation experienced by many bigender individuals.

There are also less obvious questions that have never been raised or studied systematically before. What we ordinarily regard as “normal” sexual development, differentiation and maturity involve at least five components: (1) Chromosomal sex; (2) Sexual morphology or external sexual anatomy, including secondary sexual characteristics; (3) Sexual body image; your brain constructs a vivid sense of your sexual anatomy when you close your eyes and introspect; (4) Gender; your sense of being a man or woman in society; and (5) Your sexual orientation. These subdivisions may seem arbitrary until you realize that in any individual they can be incongruent. During fetal life, childhood, and adolescence a cascade of events pertaining to these different aspects of sexuality get set in motion and develop in perfect harmony in most

individuals but in some this harmony is disrupted resulting in deviations from the mean which are, unfortunately, regarded as “abnormal” by some medical specialists. People who occupy these transitional zones of human sexuality provide a valuable opportunity to explore the manner in which genes, hormones and culture interact during brain development. Culture may be especially relevant to gender – for example – but not body image (and certainly not chromosomes!). For example, one obvious question is: Do all these aspects of sexuality (except chromosomes and external morphology) switch when the gender switch occurs, and do they do so in synchrony? Or can “uncouplings” occur? We also offer two further speculations. In myth, art, and tradition throughout the world the left side of the body (and hand) – and therefore the right hemisphere – is regarded as more “feminine” – intuitive and artistic. One wonders therefore whether gender alternation may reflect alternation of control of the two hemispheres. Such alternation is seen to a limited extent even in normal individuals but may be exaggerated (and more directly involve the gender aspect) in AGI. Indeed, hemispheric switching is atypical in bipolar illness (e.g. [12]). Multiple Personality Disorder (MPD) has also been associated with aberrant hemispheric control; often the personalities exhibit different hand preferences, as well as shifts in lateralized attention [13]. We plan to test hemispheric switching in AGI using airflow in the nostrils (a technique first described in ancient Indian texts on meditation), as well as using measures of lateralized attention. If so, would cold-caloric vestibular stimulation or transcranial magnetic stimulation (TMS) trigger a gender switch? Electroencephalography could be recorded before and after gender switches as well as before and after these methods to corroborate any association between hemispheric activation and gender state.

One also wonders whether hormone profiles – especially serum testosterone – or menstrual cycle would track the gender alternation, which would provide direct proof for the gender alternation having a physiological basis. Indeed, changes in cognition are observed across the menstrual cycle in correlation with sex hormone levels [14]. Recently, Weis et al. (2011) [15] reported imaging data showing menstrual cycle phase-related changes in lateralized brain activation within the task-dominant hemisphere (the right hemisphere for a spatial cognition task), as well as changes in connectivity between non-homotopic areas of both hemispheres. It is interesting to note that functional cerebral asymmetries are generally more pronounced in men than women, and approximately 2/3 of our survey sample was male. Could men be more prone to AGI if greater dynamic changes in laterality increase the influence of alternate hemispheres, which already show greater functional asymmetries? We are currently studying correlations between hormones and cognitive tasks that show sex differences (e.g. spatial rotation and verbal fluency) in individuals with AGI.

On a tangential note, desire to change clothes (cross-dressing) is also intriguing as it might imply that one's body image- through long standing Hebbian associations- has now incorporated the clothes of the “new” gender. This would be analogous to a blind man incorporating a cane into his arm or a Californian incorporating his sports – car into his body image in the right superior – and possibly inferior – parietal lobule. In other words cross-dressing might be a “dress rehearsal” (pun intended) attempt to restore the congruence between internal body image, gender, and external anatomy. Might AGI individuals show a sharper galvanic skin response (GSR) to poking a male (vs female) mannequin while in a male (vs female) mode? Or might they register a higher GSR response to pulling at their clothing if the clothing was congruent with their gender state, as has been shown to occur [16] when you poke a rubber hand that has been assimilated into your body image?

Conclusion

In 2007 we suggested that the systematic study of transsexuals could advance understanding of how nature and nurture interact to link brain-based internal experience of body image with external sexual morphology [3]. We believe that the study of bigender individuals, who alternately exhibit congruence and incongruence of brain-based body sex with external, morphological sex could provide significant insight into determinants of brain-sex and malleability of gender. Bigender individuals afford a unique opportunity to study gender differences within one individual person, and to study “internal sex”, including brain-sex and body image, within one individual.

Ultimately we expect AGI to be a neuropsychiatric condition; we reject false dichotomies between so-called “neurological” and “psychological” conditions [17]. Whatever its mechanisms may be, AGI opens up a question of the extent to which each of us is a multiplicity of genders, or even persons, co-existing in harmony. Clashes or sharp contrasts between components of the self may result in sharper distinctions between redundant self-networks in the brain, leading to bigenderism or, in more extreme cases, to dissociative identity disorder (DID).

Conflict of interest statement

The authors do not report any conflicts of interest in the current study.

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Appendix A. Bigender Survey Questions

Edinburgh Handedness Survey (omitted here for brevity)

Which sex were you labeled at birth (which sex is listed on your birth certificate):

- male
- female

What is your age?

Have you ever had genetic testing performed by a doctor that gives information about whether your genes are XX (usually female but sometimes male), XY (usually male but sometimes female), or something different (for example, XXX)?

If yes, please describe the results:

Have you ever been diagnosed with a psychological disorder, or sought help for one of the following conditions? (check all that apply):

- depression
- any anxiety disorder
- bipolar disorder
- schizophrenia
- autism spectrum (autism, Asperger's syndrome, other)
- multiple personality disorder
- post traumatic stress disorder
- other (please specify):

(continued on next page)

Are you currently taking hormones?

-yes

-no

If yes, please describe what hormone(s) and dose:

Have you ever tried hormones?

-yes

-no

If yes, please describe what hormone(s) and dose:

Have you ever been diagnosed with an intersex condition?

Intersex means that your genes are not clearly male or female, or that your body or genitals are not clearly male or female, but something different or in-between. For example, you might have a large clitoris that looks more like a penis, or you might have a vagina but no ovaries or uterus. (Don't count any changes due to hormones or surgery)

Do you identify as bigender?

-yes

-no

Have you ever undergone any kind of surgery to change the sex of your body, or how it appears as male vs female?

-yes

-no

If yes, please describe:

Do you feel that you switch between genders?

-yes, I switch

-maybe, I think I might switch

-no, I do not switch back and forth

The following questions were administered to participants who answered yes to the previous item:

Are your switches in gender predictable?

-yes

-no

How often do you switch *on average*? (if it varies a lot, consider the past year):

-multiple times a day

-daily

-several times a week

-weekly

-several times a month

-monthly

-several times a year

Can emotions make your gender switch?

-no

-only strong emotion

-only these emotions: _____

Can you make your gender switch, by choosing to?

-never

-once in a while

-often

-almost always or always

How do you know you have made a switch? Please describe:

What changes do you notice when you switch?

-change in thinking

-change in beliefs and values

-change in emotion or mood

-change in voice

-change in interests and activities

-change in language or spatial abilities (giving directions, finding new places)

-change in personality

-none of the above

Please describe:

When you are in one gender, can you remember what happened to you in the other gender, or do you sometimes forget about your daily experience in that gender or even the existence of that gender?

-always remember

-sometimes forget or not aware

Do you experience different personalities- for example, different selves that have different names, ages, personalities, experiences, goals, etc?

-yes

-maybe

-no; only my gender changes

If you answered yes or maybe, please describe:

Does your preference for using your right vs left hand change at all with your gender switches?

-yes

-sometimes

-no

When you are in the gender that is different from the sex of your body, do you ever feel like you have body parts that go with that sex (for example, if you are a female experiencing a male gender, do you ever feel like you have a penis, or if you are a male in female gender, do ever feel like you have breasts)? In other words, does it feel like your body has a certain body part attached to it, even though it is not there on your body? We will call these "phantom body parts" for the rest of the survey.

-yes

-no

-N/A

How strong are your phantom body parts?

1 (weak) 2 3 4 5 (very strong)

Please describe:

When, if ever, do you experience "phantom" body parts (body parts that feel like they are there, even though they really aren't)?

-never

-once in a while

-at least once a day

-multiple times a day, or whenever I think about it

-most of the time

-all the time

If you experience phantom body parts, do they switch (that is, come and go) with your gender?

-always

-almost always

-sometimes

-rarely

-never

-N/A

Do you ever get phantoms from one gender that get "stuck" and stays in the gender that does not match (for example, if

you have a female body and you are in female mode, a phantom penis persists, or if you have a male body and are in male mode, you still feel phantom breasts)

- always
- almost always
- sometimes
- rarely
- never
- N/A

What else would you like us to know about your bigenderism?

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